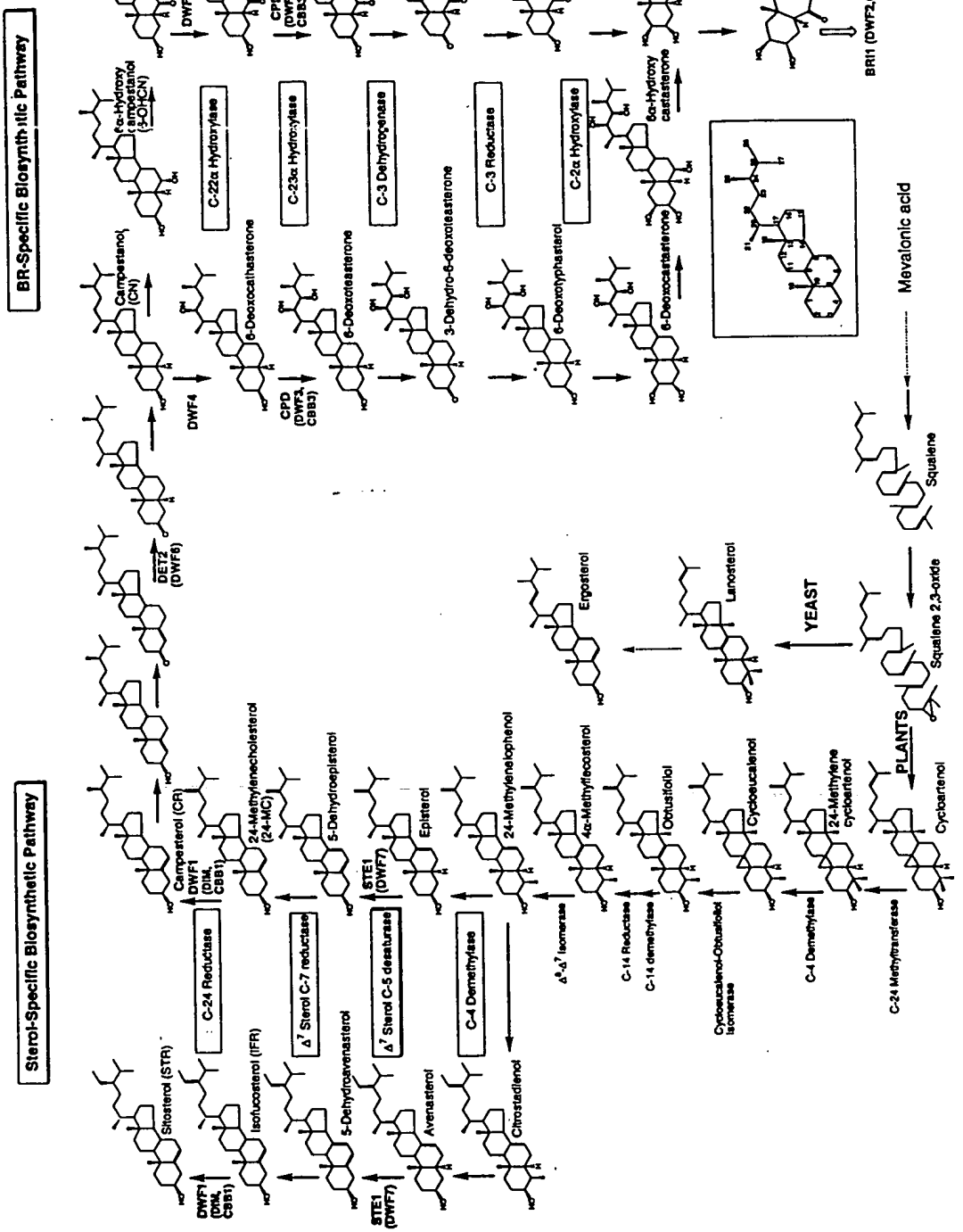
BR-Specific Biosynthetic Pathway
Sterol-Specific Biosynthetic Pathway
Mevalonic acid
Squalene
Squalene 2,3-oxide
YEAST
PLANTS
Cycloartenol
Obtusifoliol
Cycloeucalenol
Lanosterol
Ergosterol
Campesterol (CR)
Campestanol (CN)
Stigmasterol (STR)
Isofucosterol (IFR)
Avenasterol
Citrostadienol
Episterol
24-Methylenecholesterol (24-MC)
5-Dehydroepisterol
5-Dehydroavenasterol
24-Methylenelophenol
4α-Methylfecosterol
6-Deoxocathasterone
6-Deoxoteasterone
3-Dehydro-6-deoxoteasterone
6-Deoxotyphasterol
6-Deoxocastasterone
6α-Hydroxy castasterone
6α-Hydroxy campestanol (3-OHCN)
6-Oxocampestanol (6-OxoCN)
Cathasterone (CT)
Teasterone (TE)
3-Dehydroteasterone (3-DehydroTE)
Typhasterol (TY)
Castasterone (CS)
Brassinolide (BL)
C-24 Reductase
Δ7 Sterol C-7 reductase
Δ7 Sterol C-5 desaturase
C-4 Demethylase
Δ8-Δ7 Isomerase
C-14 Reductase
C-14 demethylase
Cycloeucalenol-Obtusifoliol Isomerase
C-4 Demethylase
C-24 Methyltransferase
DWF1 (DIM, CBB1)
STE1 (DWF7)
DET2 (DWF6)
DWF4
CPD (DWF3, CBB3)
C-22α Hydroxylase
C-23α Hydroxylase
C-3 Dehydrogenase
C-3 Reductase
C-2α Hydroxylase
BR11 (DWF2,CBB2)

FIG. 1

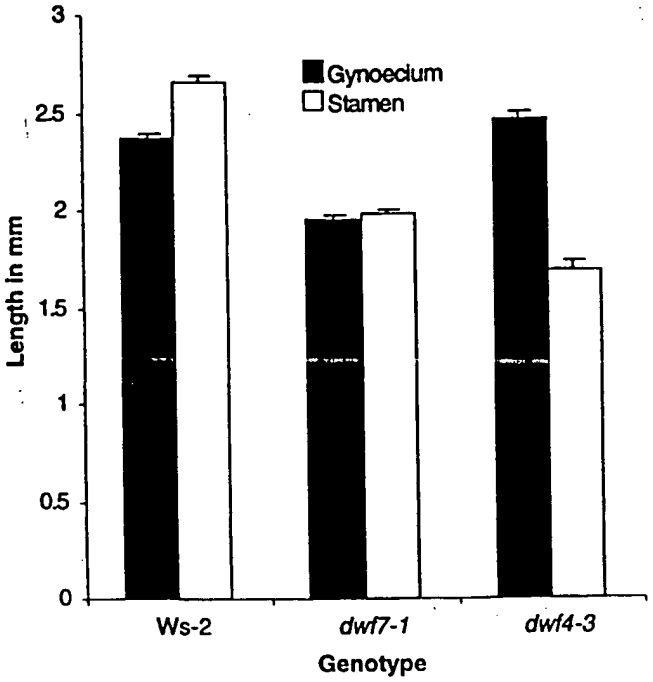
Gynoecium
Stamen
Length in mm
3
2.5
2
1.5
1
0.5
0
Ws-2
dwf7-1
dwf4-3
Genotype

FIG. 2

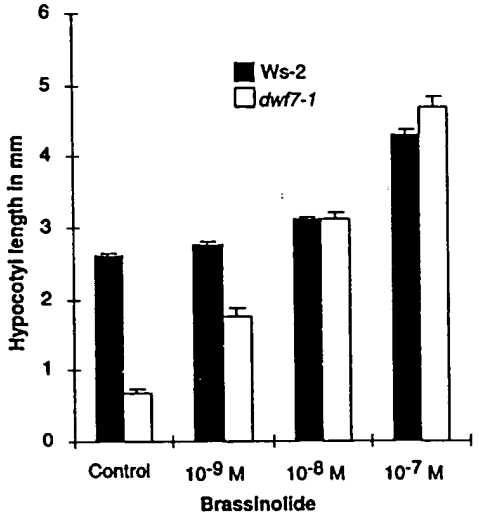
Ws-2
dwf7-1
Hypocotyl length in mm
6
5
4
3
2
1
0
Control
10-9 M
10-8 M
10-7 M
Brassinolide

FIG. 3

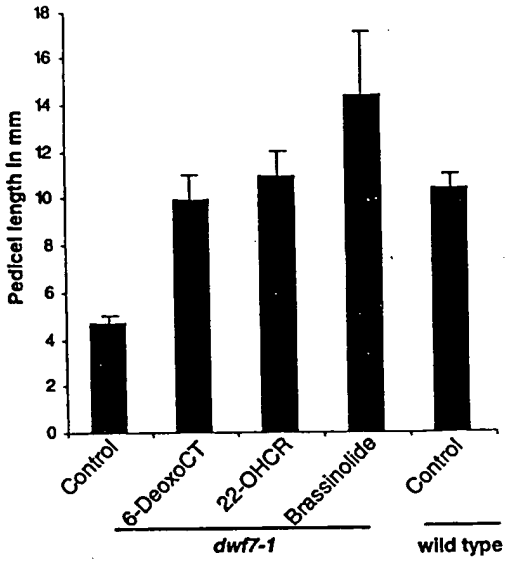
Pedicel length in mm
18
16
14
12
10
8
6
4
2
0
Control
6-DeoxoCT
22-OHCR
Brassinolide
Control
dwf7-1
wild type

FIG. 4

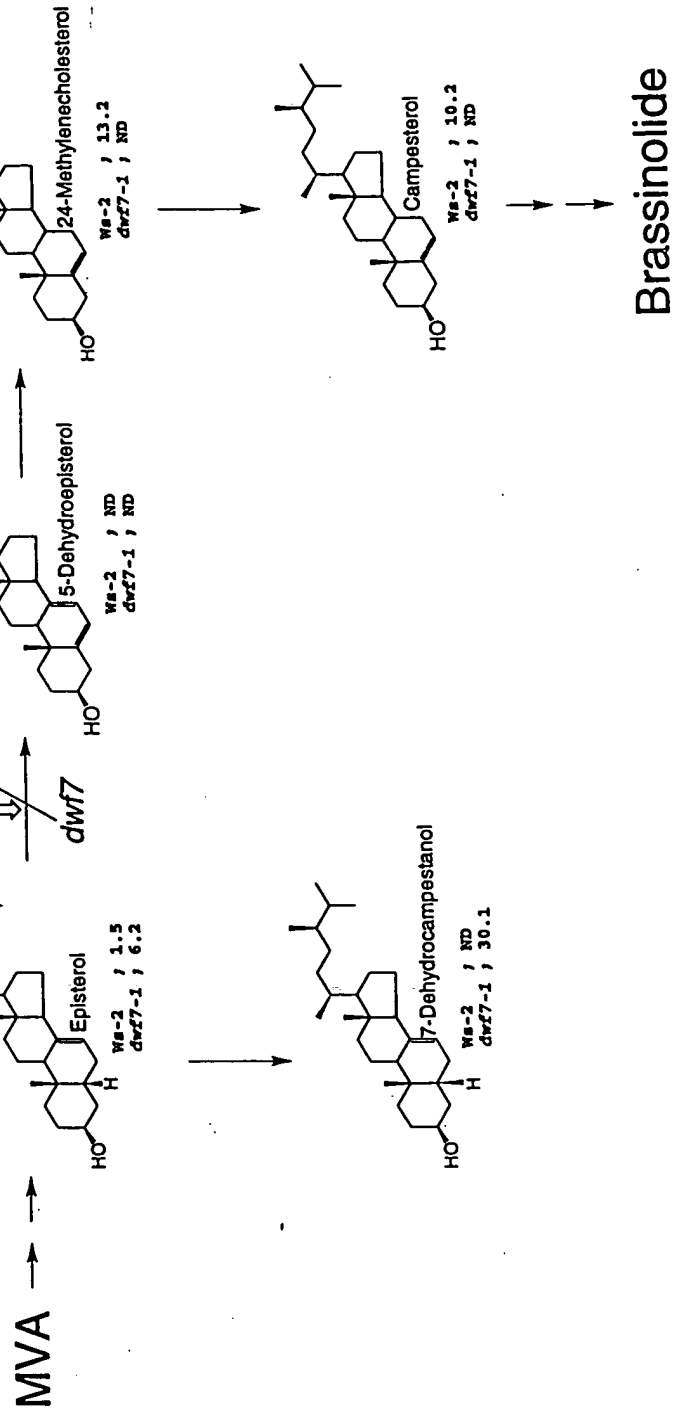
MVA
Episterol
Ws-2 / 1.5
dwf7-1 / 6.2
Δ7 sterol C-5 desaturase
dwf7
5-Dehydroepisterol
Ws-2 / ND
dwf7-1 / ND
7-Dehydrocampestanol
Ws-2 / ND
dwf7-1 / 30.1
24-Methylenecholesterol
Ws-2 / 13.2
dwf7-1 / ND
Campesterol
Ws-2 / 10.2
dwf7-1 / ND
Brassinolide

FIG. 5

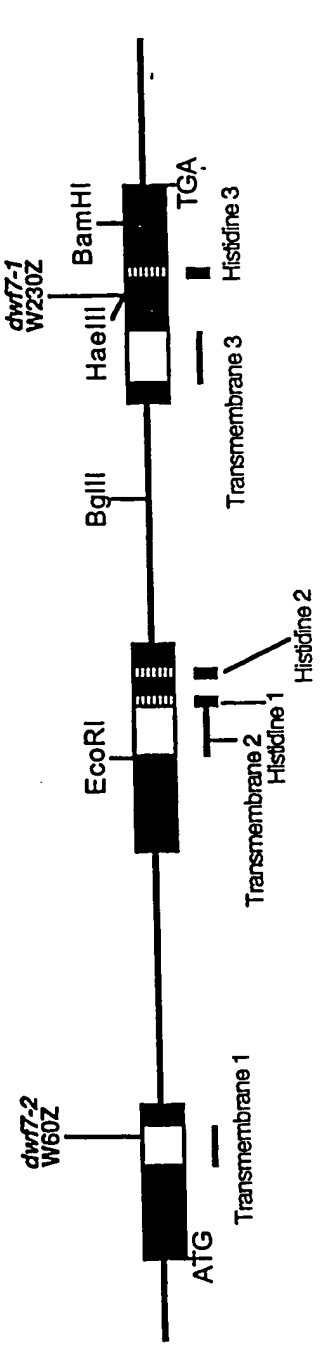
120
TGA
BamHI
dwf7-1
W230Z
HaeIII
Histidine 3
Transmembrane 3
BglII
Histidine 2
Histidine 1
EcoRI
Transmembrane 2
dwf7-2
W60Z
Transmembrane 1
ATG

FIG. 6

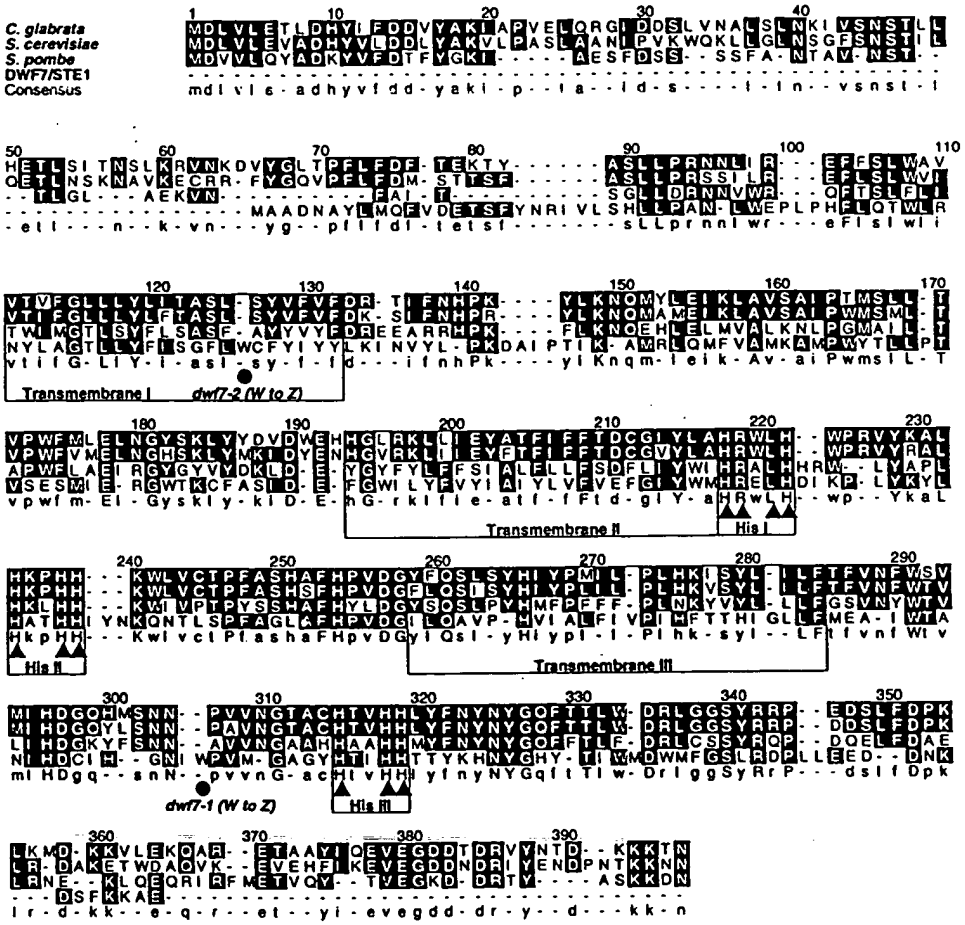

FIG. 7

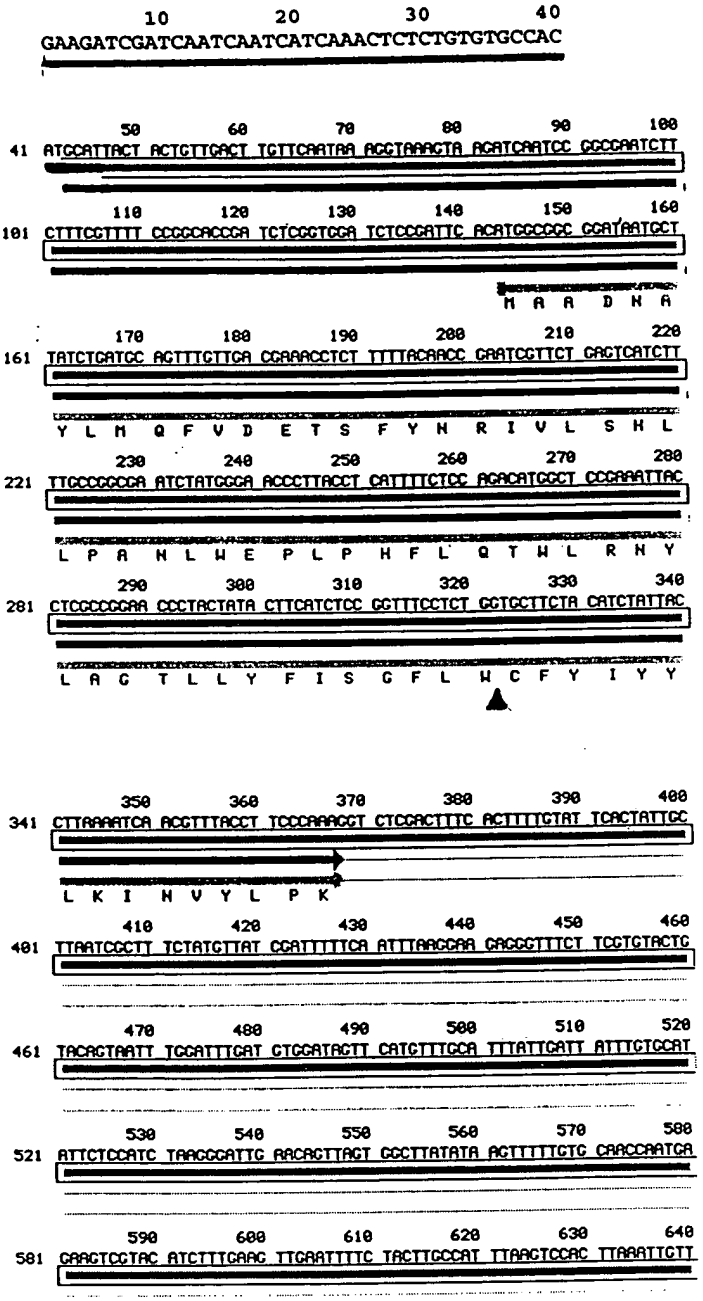
10 20 30 40
GAAGATCGATCAATCAATCATCAAACTCTCTGTGTGCCAC
50 60 70 80 90 100
41 ATGCATTACT ACTGTTGACT TGTTCAATAA ACGTAAAGTA ACATCAATCC GCCCAATCTT
110 120 130 140 150 160
101 CTTTCGTTTT CCCGCACCGA TCTCCGTCGA TCTCCGATTC ACATGCCCGC CCATAATGCT
M A A D N A
170 180 190 200 210 220
161 TATCTGATGC AGTTTGTTCA CGAAACCTCT TTTTACAACC GAATCGTTCT CACTCATCTT
Y L M Q F V D E T S F Y N R I V L S H L
230 240 250 260 270 280
221 TTGCCCGCCA ATCTATCGCA ACCCTTACCT CATTTTCTCC AGACATCGCT CCCAAATTAC
L P A N L W E P L P H F L Q T W L R N Y
290 300 310 320 330 340
281 CTCGCCCGAA CCCTACTATA CTTCATCTCC CGTTTCCTCT CGTCCTTCTA CATCTATTAC
L A C T L L Y F I S C F L W C F Y I Y Y
350 360 370 380 390 400
341 CTTAAAATCA ACGTTTACCT TCCCAAACGT CTCCACTTTC ACTTTTGTAT TCACTATTGC
L K I N V Y L P K
410 420 430 440 450 460
401 TTAATCCCTT TCTATGTTAT CCATTTTTCA ATTTAACGAA CACGCTTTCT TCGTGTACTG
470 480 490 500 510 520
461 TACAGTAATT TCCATTTGAT CTGCATACTT CATGTTTGCA TTTATTGATT ATTTGTCCAT
530 540 550 560 570 580
521 ATTCTCCATC TAACGCATTG AACAGTTACT CCCTTATATA ACTTTTTGTG CAACCAATGA
590 600 610 620 630 640
581 GAAGTCCTAC ATCTTTGAAC TTGAATTTTC TACTTGCCAT TTAAGTCCAC TTAAATTGTT

FIG. 8A

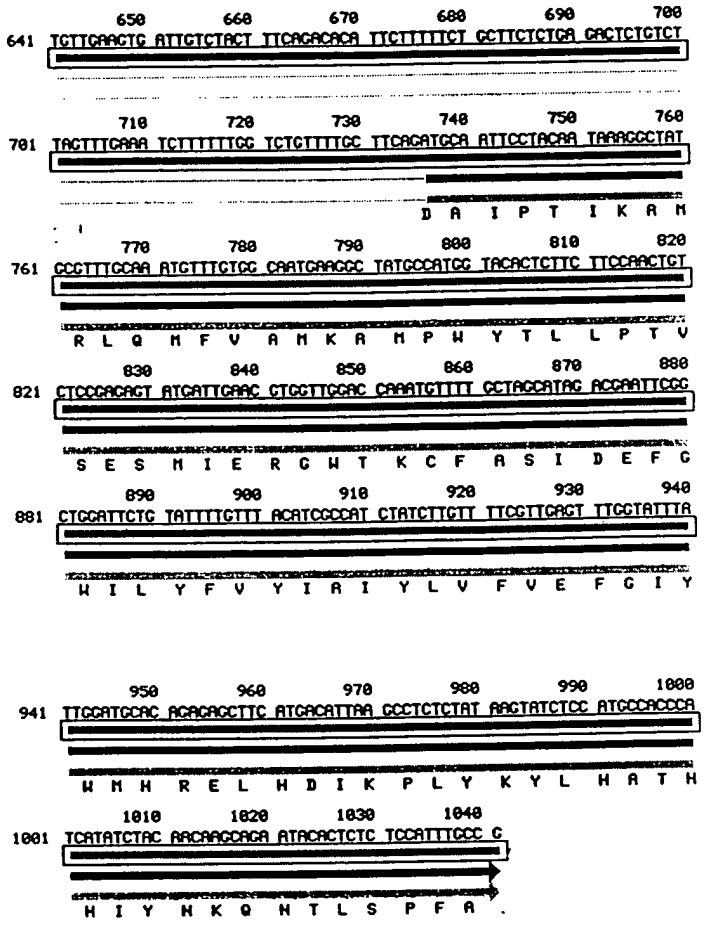
650 660 670 680 690 700
641 TGTTGAACTG ATTGTCTACT TTCAGACACA TTCTTTTTCT GCTTCTCTGA GACTCTGTCT
710 720 730 740 750 760
701 TACTTTGAAA TCTTTTTTGG TCTGTTTTGC TTCAGATGCA ATTCCTACAA TAAAGCCTAT
D A I P T I K A M
770 780 790 800 810 820
761 CCGTTTGCAA ATGTTTGTGC CAATGAAGCC TATGCCATGC TACACTCTTC TTCCAACTGT
R L Q M F V A M K A M P W Y T L L P T V
830 840 850 860 870 880
821 CTCCGACAGT ATGATTGAAC CTGCTTCCAC CAAATGTTTT CCTACCATAG ACGAATTCCG
S E S M I E R C W T K C F A S I D E F G
890 900 910 920 930 940
881 CTGCATTCTG TATTTTGTTT ACATCGCCAT CTATCTTGTT TTCGTTGACT TTGGTATTTA
W I L Y F V Y I A I Y L V F V E F G I Y
950 960 970 980 990 1000
941 TTGCATGCAC ACACAGCTTC ATGACATTAA GCCTCTCTAT AACTATCTCC ATCCCACCCA
W M H R E L H D I K P L Y K Y L H A T H
1010 1020 1030 1040
1001 TCATATCTAC AACAAGCAGA ATACACTCTC TCCATTTGCC G
H I Y N K Q N T L S P F A .

FIG. 8B

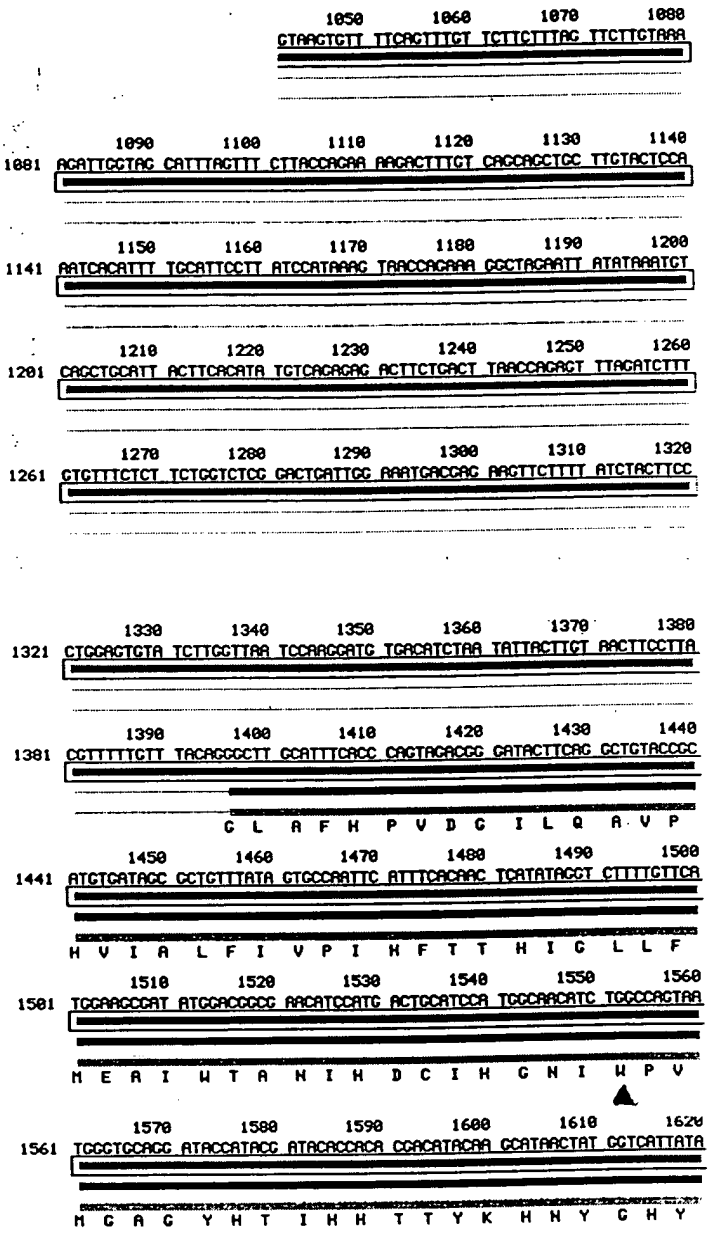
1050 1060 1070 1080
GTAAGTGTT TTCAGTTTGT TCTTCTTTAG TTCTTGTAAA
1081 1090 1100 1110 1120 1130 1140
ACATTGCTAC CATTTACTTT CTTACCAGAA AAGACTTTGT CACCAGCTGC TTGTACTCCA
1141 1150 1160 1170 1180 1190 1200
AATCACATTT TGCATTCCTT ATCCATAAAG TAACCAGAAA GCCTAGAATT ATATAAATGT
1201 1210 1220 1230 1240 1250 1260
CAGCTGCATT ACTTCACATA TGTCAGAGAG ACTTCTGACT TAACCAGAGT TTAGATCTTT
1261 1270 1280 1290 1300 1310 1320
GTGTTTCTCT TCTGGTCTCG GACTGATTGG AAATGACCAG AAGTTCTTTT ATCTACTTCC
1321 1330 1340 1350 1360 1370 1380
CTGCAGTGTA TCTTGCTTAA TCCAAGGATG TGACATCTAA TATTACTTGT AACTTCCTTA
1381 1390 1400 1410 1420 1430 1440
CGTTTTTGTT TACAGCGCTT GCATTTCACC CAGTACACGG CATACTTCAG GCTGTACCCC
C L A F H P V D C I L Q A V P
1441 1450 1460 1470 1480 1490 1500
ATGTCATAGC GCTGTTTATA GTGCCAATTC ATTTCACAAC TCATATACGT CTTTTGTTCA
H V I A L F I V P I H F T T H I C L L F
1501 1510 1520 1530 1540 1550 1560
TCGAACCGAT ATGCACCCCC AACATCCATG ACTGCATCCA TGCCAACATC TCGCCAGTAA
M E A I W T A N I H D C I H C N I W P V
1561 1570 1580 1590 1600 1610 1620
TCGCTGCAGG ATACCATACC ATACACCACA CCACATACAA GCATAACTAT CGTCATTATA
M G A G Y H T I H H T T Y K H N Y G H Y

FIG. 8C

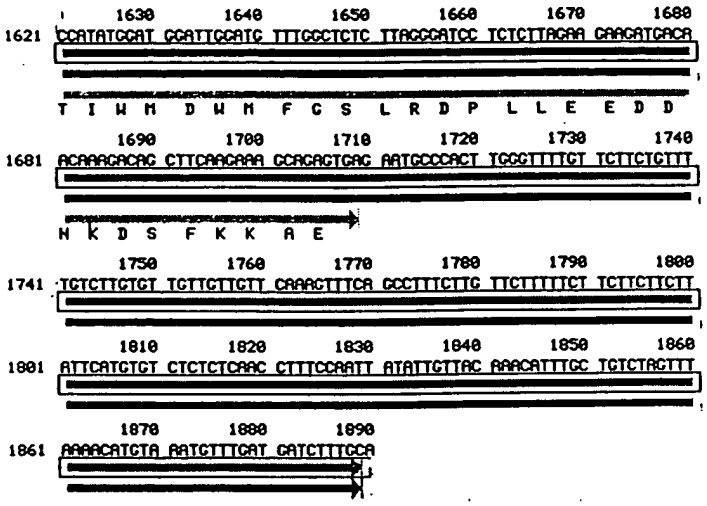
1630 1640 1650 1660 1670 1680
1621 CCATATCCAT GCATTCCATC TTTCCCTCTC TTACCGATCC TCTCTTAGAA CAACATCACA
T I W H D W H F C S L R D P L L E E D D
1690 1700 1710 1720 1730 1740
1681 ACAAAGACAC CTTCAACAAA CCAGACTGAC AATGCCCACT TCCGTTTTCT TCTTCTGTTT
H K D S F K K A E
1750 1760 1770 1780 1790 1800
1741 TCTCTTCTGT TGTTGTTGTT CAAACTTTCA GCCTTTCTTG TTCTTTTTCT TCTTCTTCTT
1810 1820 1830 1840 1850 1860
1801 ATTCATCTGT CTCTCTCAAC CTTTCCAATT ATATTGTTAC AAACATTTGC TGTCTAGTTT
1870 1880 1890
1861 AAAACATCTA AATGTTTGAT GATCTTTGCA

FIG. 8D

```
  1  MAADNAYLMQ FVDETSFYNR IVLSHLLPAN LWEPLPHFLQ TWLRNYLAGT

 51  LLYFISGFLW CFYIYYLKIN VYLPKDAIPT IKAMRLQMFV AMKAMPWYTL

101  LPTVSESMIE RGWTKCFASI DEFGWILYFV YIAIYLVFVE FGIYWMHREL

151  HDIKPLYKYL HATHHIYNKQ NTLSPFAGLA FHPVDGILQA VPHVIALFIV

201  PIHFTTHIGL LFMEAIWTAN IHDCIHGNIW PVMGAGYHTI HHTTYKHNYG

251  HYTIWMDWMF GSLRDPLLEE DDNKDSFKKA E
```

FIG. 9

```
        10                  30                  50
         .         .         .         .         .         .
GTTTGGTATTTATTGGATGCACAGAGAGCTTCATGACATTAAGCCTCTCTATAAGTATCT
CAAACCATAAATAACCTACGTGTCTCTCGAAGTACTGTAATTCGGAGAGATATTCATAGA

        70                  90                  110
         .         .         .         .         .         .
CCATGCCACCCATCATATCTACAACAAGCAGAATACACTCTCTCCATTTGCCGGTAAGTG
GGTACGGTGGGTAGTATAGATGTTGTTCGTCTTATGTGAGAGAGGTAAACGGCCATTCAC

       130                 150                 170
         .         .         .         .         .         .
TTTTCAGTTTGTTCTTCTTTAGTTCTTGTAAAAGATTGGTAGCATTTAGTTTCTTACCAG
AAAAGTCAAACAAGAAGAAATCAAGAACATTTTCTAACCATCGTAAATCAAAGAATGGTC

       190                 210                 230
         .         .         .         .         .         .
AAAAGACTTTGTCAGCAGCTGCTTGTACTCCAAATCACATTTTGCATTCCTTATCCATAA
TTTTCTGAAACAGTCGTCGACGAACATGAGGTTTAGTGTAAAACGTAAGGAATAGGTATT

       250                 270                 290
         .         .         .         .         .         .
AGTAACCAGAAAGGCTAGAATTATATAAATGTCAGCTGCATTACTTCACATATGTCAGAG
TCATTGGTCTTTCCGATCTTAATATATTTACAGTCGACGTAATGAAGTGTATACAGTCTC

       310                 330                 350
         .         .         .         .         .         .
AGACTTCTGACTTAACCAGAGTTTAGATCTTTGTGTTTCTCTTCTGGTCTCGGACTGATT
TCTGAAGACTGAATTGGTCTCAAATCTAGAAACACAAAGAGAAGACCAGAGCCTGACTAA

       370                 390                 410
         .         .         .         .         .         .
GGAAATGACGAGAAGTTCTTTTATCTACTTCCCTGGAGTGTATCTTGGTTAATCCAAGGA
CCTTTACTGCTCTTCAAGAAAATAGATGAAGGGACCTCACATAGAACCAATTAGGTTCCT

       430                 450                 470
         .         .         .         .         .         .
TGTGACATCTAAATATTACTTGTAACTTCCTTACGTTTTTGTTTACAGGGCTTGCATTCA
ACACTGTAGATTTATAATGAACATTGAAGGAATGCAAAAACAAATGTCCCGAACGTAAGT

       490                 510                 530
         .         .         .         .         .         .
CCCAGTAGACGGGATACTTAAGGCTGTACCGCATGTGATAGCGCTGTTATAGTGCCAATT
GGGTCATCTGCCCTATGAATTCCGACATGGCGTACACTATCGCGACAATATCACGGTTAA

       550                 570                 590
         .         .         .         .         .         .
CATTTCACAACTCATATAGGTCTTTTGTTCATGGAAGCGATATGGACGGCGAACATCCAT
GTAAAGTGTTGAGTATATCCAGAAAACAAGTACCTTCGCTATACCTGCCGCTTGTAGGTA
```

FIG. 10A

```
      610                 630                 650
       .         .         .         .         .         .
GACTGCATCCATGGCAACATCTGGCCAGTAATGGGTGCAGGATACCATACGATACACCAC
CTGACGTAGGTACCGTTGTAGACCGGTCATTACCCACGTCCTATGGTATGCTATGTGGTG

      670                 690                 710
       .         .         .         .         .         .
ACGACATACAAGCATAACTATGGTCATTATACCATATGGATGGATTGGATGTTTGGCTCT
TGCTGTATGTTCGTATTGATACCAGTAATATGGTATACCTACCTAACCTACAAACCGAGA

      730                 750                 770
       .         .         .         .         .         .
CTTAGGGATCCTCTCTTAGAAGAAGATGACAACAAAGACAGCTTCAAGAAAGCAGAGTGA
GAATCCCTAGGAGAGAATCTTCTTCTACTGTTGTTTCTGTCGAAGTTCTTTCGTCTCACT

      790                 810                 830
       .         .         .         .         .         .
GAATGCCCACTTGGGTTTTGTTCTTCTGTTTTGTCTTGTGTTGTTGTTGTTCAAAGTTTC
CTTACGGGTGAACCCAAAACAAGAAGACAAAACAGAACACAACAACAACAAGTTTCAAAG

      850                 870                 890
       .         .         .         .         .         .
AGCCTTTCTTGTTCTTTTTCTTCTTCTTCTTATTCATGTGTCTCTCTCAACCTTTCCAAT
TCGGAAAGAACAAGAAAAAGAAGAAGAAGAATAAGTACACAGAGAGAGTTGGAAAGGTTA

      910                 930                 950
       .         .         .         .         .         .
TATATTGTTACAAACATTTGCTGTCTAGTTTAAAACATGTAAATGTTTGATGATCTTTGC
ATATAACAATGTTTGTAAACGACAGATCAAATTTTGTACATTTACAAACTACTAGAAACG

      970                 990                1010
       .         .         .         .         .         .
AAGACTCCATTTTTGTTTAAGGTAAACCTTGAATCTCATAGATTGTCGATTGTTGGTATT
TTCTGAGGTAAAAACAAATTCCATTTGGAACTTAGAGTATCTAACAGCTAACAACCATAA

     1030                1050                1070
       .         .         .         .         .         .
TCCATTTTCAGGTACGGTTCTGTAGACTGTAGTCTTGCTGACCAGTCCGGCTTAACCACC
AGGTAAAAGTCCATGCCAAGACATCTGACATCAGAACGACTGGTCAGGCCGAATTGGTGG

     1090                1110                1130
       .         .         .         .         .         .
CCAAATTTCAAAGATCTCAcCAATCAAAATGCTGGCTGGCCCCAATATATAGATGGGCCA
GGTTTAAAGTTTCTAGAGTgGTTAGTTTTACGACCGACCGGGGTTATATATCTACCCGGT

     1150                1170                1190
       .         .         .         .         .         .
GTTAATCCGTCTAGCTTTACTCTTTAGACCTACCTTAGACAGTTAGACACCTGCTAATTA
CAATTAGGCAGATCGAAATGAGAAATCTGGATGGAATCTGTCAATCTGTGGACGATTAAT
```

FIG. 10B

```
      1210                1230                1250
       .   .   .   .   .   .   .   .   .   .   .   .
ATGAGTTTCCTTTTTCTTGTTCAGCAAGTTACCTGTGTTACTTGAGAGTTGAGTTAATGG
TACTCAAAGGAAAAAGAACAAGTCGTTCAATGGACACAATGAACTCTCAACTCAATTACC

      1270                1290                1310
       .   .   .   .   .   .   .   .   .   .   .   .
TAGTAAACGCAATTTAACCCTTATAAGTTTAATCGTATTCAACGAATGACCCAGAGACTT
ATCATTTGCGTTAAATTGGGAATATTCAAATTAGCATAAGTTGCTTACTGGGTCTCTGAA

      1330                1350                1370
       .   .   .   .   .   .   .   .   .   .   .   .
TAAATAAATCCATCGTAACCCTCCACTTCAAAATTCTTTTTAAAAAGTAGCAAATCATTT
ATTTATTTAGGTAGCATTGGGAGGTGAAGTTTTAAGAAAAATTTTTCATCGTTTAGTAAA

      1390                1410                1430
       .   .   .   .   .   .   .   .   .   .   .   .
AAATATTGTAAGTTTGCTTCATTCGAAATTGTAGCTACAGATCTCAAAGCTCCTCCTGTT
TTTATAACATTCAAACGAAGTAAGCTTTAACATCGATGTCTAGAGTTTCGAGGAGGACAA

      1450                1470                1490
       .   .   .   .   .   .   .   .   .   .   .   .
GGCCATATCTCTCTCTAACAAACGCATAGTAACACTTGACCACAGTTTGACTTCTCGGCG
CCGGTATAGAGAGAGATTGTTTGCGTATCATTGTGAACTGGTGTCAAACTGAAGAGCCGC

      1510                1530                1550
       .   .   .   .   .   .   .   .   .   .   .   .
GTTTCATGGCGGCGACTATGGCAGATTATAATGATCAGATCGTCAATGAGACCTCTTTTT
CAAAGTACCGCCGCTGATACCGTCTAATATTACTAGTCTAGCAGTTACTCTGGAGAAAAA
     M   A   A   T   M   A   D   Y   N   D   Q   I   V   N   E   T   S   F   Y

      1570                1590                1610
       .   .   .   .   .   .   .   .   .   .   .   .
ACAACCGAAtGGTTCTGAGTCACCTTTTGCCGgTGAATCTATGGGAACCTTTACCaCATT
TGTTGGCTTaCCAAGACTCAGTGGAAAACGGCcACTTAGATACCCTTGGAAATGGtGTAA
  N   R   M   V   L   S   H   L   L   P   V   N   L   W   E   P   L   P   H   F

      1630                1650                1670
       .   .   .   .   .   .   .   .   .   .   .   .
TCCTCCAGACATGGCTCCGGAACTACCTCGCCGGAAACATACTCTACTTCATCTCCGGCT
AGGAGGTCTGTACCGAGGCCTTGATGGAGCGGCCTTTGTATGAGATGAAGTAGAGGCCGA
  L   Q   T   W   L   R   N   Y   L   A   G   N   I   L   Y   F   I   S   G   F

      1690                1710                1730
       .   .   .   .   .   .   .   .   .   .   .   .
TCCTCTGGTGCTTCTACATCTATTACCTTAAACTCAACGTTTACGTCCCCAAAGGTTACT
AGGAGACCACGAAGATGTAGATAATGGAATTTGAGTTGCAAATGCAGGGGTTTCCAATGA
  L   W   C   F   Y   I   Y   Y   L   K   L   N   V   Y   V   P   K
```

FIG. 10C

```
      1750                 1770                 1790
       .    .    .    .    .    .    .    .    .    .
TTTTTCAATTTCGATGTTCTGTTTTGAAACCTTTCTTTTGTTGATTCCTTCGATTGTATC
AAAAAGTTAAAGCTACAAGACAAAACTTTGGAAAGAAAACAACTAAGGAAGCTAACATAG

      1810                 1830                 1850
       .    .    .    .    .    .    .    .    .    .
GCCTGATAGATTGTGTTATACGTTAACCTTTTTTTCTTACTGTTACTTTCAGTTCTTGTC
CGGACTATCTAACACAATATGCAATTGGAAAAAAAGAATGACAATGAAAGTCAAGAACAG

      1870                 1890                 1910
       .    .    .    .    .    .    .    .    .    .
TTCTACTTCTCATTTAATTAGTTTTAAAGTTTAATATTTTTGGCTAATCCACATTTTTTA
AAGATGAAGAGTAAATTAATCAAAATTTCAAATTATAAAAACCGATTAGGTGTAAAAAAT

      1930                 1950                 1970
       .    .    .    .    .    .    .    .    .    .
AGTTGAATCTTCCATGAAATTTGAGCTCAAAATATACCATGAAATTGAAATTTGTGGTTC
TCAACTTAGAAGGTACTTTAAACTCGAGTTTTATATGGTACTTTAACTTTAAACACCAAG

      1990                 2010                 2030
       .    .    .    .    .    .    .    .    .    .
TTAGTTCTATTTCTTGCTTGGTTTCTTCTATTTTTGTGGTTAGAATCCATTCCTACGAGA
AATCAAGATAAAGAACGAACCAAAGAAGATAAAAACACCAATCTTAGGTAAGGATGCTCT
                                          E  S  I  P  T  R

      2050                 2070                 2090
       .    .    .    .    .    .    .    .    .    .
AAGGCAATGCTTTTGCAAATATACGTGGCAATGAAGGCTATGCCTTGGTACACTCTTCTT
TTCCGTTACGAAAACGTTTATATGCACCGTTACTTCCGATACGGAACCATGTGAGAAGAA
K  A  M  L  L  Q  I  Y  V  A  M  K  A  M  P  W  Y  T  L  L

      2110                 2130                 2150
       .    .    .    .    .    .    .    .    .    .
CCAGCTGTCTCTGAGTATATGATCGAGCATGGTTGGACCAAATGTTACTCTACACTTGAC
GGTCGACAGAGACTCATATACTAGCTCGTACCAACCTGGTTTACAATGAGATGTGAACTG
P  A  V  S  E  Y  M  I  E  H  G  W  T  K  C  Y  S  T  L  D

      2170                 2190                 2210
       .    .    .    .    .    .    .    .    .    .
CATTTCAACTGGTTCCTCTGTTTCCTCTACATAGCTCTCTATCTTGTTTTAGTTGAGTTt
GTAAAGTTGACCAAGGAGACAAAGGAGATGTATCGAGAGATAGAACAAAATCAACTCAAa
H  F  N  W  F  L  C  F  L  Y  I  A  L  Y  L  V  L  V  E  F

      2230                 2250                 2270
       .    .    .    .    .    .    .    .    .    .
ATGATTTATTGGGTTCACAAAGAGCTTCATGACATTAAATTTCTCTATAAGCATCTCCAT
TACTAAATAACCCAAGTGTTTCTCGAAGTACTGTAATTTAAAGAGATATTCGTAGAGGTA
M  I  Y  W  V  H  K  E  L  H  D  I  K  F  L  Y  K  H  L  H
```

FIG. 10D

```
      2290                2310                2330
        .         .         .         .         .         .
GCTACCCATCATATGTACAACAAGCAAAACACACTCTCTCCATTTGCCGGTATGTCAAAG
CGATGGGTAGTATACATGTTGTTCGTTTTGTGTGAGAGAGGTAAACGGCCATACAGTTTC
A  T  H  H  M  Y  N  K  Q  N  T  L  S  P  F  A

      2350                2370                2390
        .         .         .         .         .         .
CTATATGTTCTCAATCTAAATTCAAGAGCTTGTATCAATGGTGACTTCTTTACTTGATGT
GATATACAAGAGTTAGATTTAAGTTCTCGAACATAGTTACCACTGAAGAAATGAACTACA

      2410                2430                2450
        .         .         .         .         .         .
TTTTCGGGTTTTCAGGGCTCGCATTCCATCCGCTGGACGGGATACTTCAGGCTATACCGC
AAAAGCCCAAAAGTCCCGAGCGTAAGGTAGGCGACCTGCCCTATGAAGTCCGATATGGCG
               G  L  A  F  H  P  L  D  G  I  L  Q  A  I  P  H

      2470                2490                2510
        .         .         .         .         .         .
ACGTGATAGCGCTGTTTATAGTGCCGATTCATCTCATAACACATCTGAGTCTTTTGTTTT
TGCACTATCGCGACAAATATCACGGCTAAGTAGAGTATTGTGTAGACTCAGAAAACAAAA
  V  I  A  L  F  I  V  P  I  H  L  I  T  H  L  S  L  L  F  L

      2530                2550                2570
        .         .         .         .         .         .
TGGAAGGGATATGGACAGCAAGCATCCATGATTGCATACATGGtAACATCTGGCCTATAA
ACCTTCCCTATACCTGTCGTTCGTAGGTACTAACGTATGTACCaTTGTAGACCGGATATT
  E  G  I  W  T  A  S  I  H  D  C  I  H  G  N  I  W  P  I  M

      2590                2610                2630
        .         .         .         .         .         .
TGGGTGCAGGATACCATACCATACACCATACAACATACAAGCATAACTATGGTCATTATa
ACCCACGTCCTATGGTATGGTATGTGGTATGTTGTATGTTCGTATTGATACCAGTAATAt
  G  A  G  Y  H  T  I  H  H  T  T  Y  K  H  N  Y  G  H  Y  T

      2650                2670                2690
        .         .         .         .         .         .
CCATATGGATGGaCTGGATGTTTGGCTCTCTTATGGTTCCTTTAGCAGAAAAAGACAGTT
GGTATACCTACCtGACCTACAAACCGAGAGAATACCAAGGAAATCGTCTTTTTCTGTCAA
  I  W  M  D  W  M  F  G  S  L  M  V  P  L  A  E  K  D  S  F

      2710                2730                2750
        .         .         .         .         .         .
TCAAGGAGAAAGAAAAGTGAGAATGTTCAATGCTCACATGTATTCTTCATATGTTGCTCT
AGTTCCTCTTTCTTTTCACTCTTACAAGTTACGAGTGTACATAAGAAGTATACAACGAGA
  K  E  K  E  K  *

      2770                2790                2810
        .         .         .         .         .         .
TCTCGTGACTCTTATTAAAACCTTTCTAATCACTTTGGTGGAATTAAAAACATGACTGCA
AGAGCACTGAGAATAATTTTGGAAAGATTAGTGAAACCACCTTAATTTTTGTACTGACGT
```

FIG. 10E

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      2830                2850                2870
        .         .         .         .         .         .
TAATTTGATGCAAAGTTTCAGACTTTTATTGCTAAAAATCTCTGATGATTATTAACCTCA
ATTAAACTACGTTTCAAAGTCTGAAAATAACGATTTTTAGAGACTACTAATAATTGGAGT

      2890                2910
        .         .         .         .
ATTATATAATTGcTGGATGAAGAGTTCAAATTTGGACTAAATCTG
TAATATATTAACgACCTACTTCTCAAGTTTAAACCTGATTTAGAC
```

FIG. 10F

```
1    maatmadynd qivnetsfyn rmvlshllpv nlweplphfl qtwlrnylag
51   nilyfisgfl wcfyiyylkl nvyvpkesip trkamllqiy vamkampwyt
101  llpavseymi ehgwtkcyst ldhfnwflcf lyialylvlv efmiywvhke
151  lhdikflykh lhathhmynk qntlspfagl afhpldgilq aiphvialfi
201  vpihlithls llflegiwta sihdcihgni wpimgagyht ihhttykhny
251  ghytiwmdwm fgslmvplae kdsfkekek
```

FIG. 11